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QA Inspection Via Condition Monitoring

4

Guidelines for Quality Assurance Inspection of Commercial Activities Contracts for Real Property Maintenance Activities

Guide #2: Wastewater Systems

by

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A Quality Assurance (QA) Program allows the Army to evaluate and document a contractor's work performance. It depends on a QA Surveillance Plan (QASP). The QASP, which is based on the contract Performance Work Statement, lists contractor activities and the surveillance approach, number of items to be inspected, and an Acceptable Quality Level (AQL) for each activity. This series of 12 guides will help the Contracting Officer's Representative/Quality Assurance Evaluator by defining and clarifying the inspection tasks required by the QASP, which will facilitate inspection uniformity and effectiveness.

This guide discusses QA monitoring of wastewater collection and wastewater treatment systems.

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FOREWORD

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GUIDELINES FOR QUALITY ASSURANCE INSPECTION OF COMMERCIAL ACTIVITIES CONTRACTS FOR REAL PROPERTY MAINTENANCE ACTIVITIES GUIDE #2: WASTEWATER SYSTEMS

1 INTRODUCTION

Background

A Quality Assurance (QA) program allows the Army to evaluate and document a contractor's performance. The Quality Assurance Evaluator (QAE) conducts skilled and carefully planned inspections aimed at verifying the satisfactory completion of contractor work. The inspections evaluate the quality, quantity, and timeliness of the services provided, not the contractor's methods used in performing the work. A good QA program promotes the best possible product within the terms of the standing contract.

A well organized QA program depends on a QA Surveillance Plan (QASP), which is prepared by the Government and contains the purpose and methods of the QA program. Although the QASP is not a part of the contract, it is based on the contract Performance Work Statement, which is part of the contract. The QASP lists contractor activities and the surveillance approach, approximate number of items to be surveyed, and an Acceptable Quality Level (AQL) for each activity.

The installation Director of Public Works (DPW), the Contracting Officer (KO), or the Contracting Officer's Representative (COR) often oversees the QASP. The COR/QAE needs an inspection guide to help define and clarify the inspection tasks required by the QASP, and to facilitate inspection uniformity and effectiveness. To meet this need, the U.S. Army Construction Engineering Research Laboratories (USACERL) developed this series of 12 inspection guides.

Objective

This guide series is intended to supplement any existing QASP and to provide QA guidance for evaluating Operations and Maintenance (O&M) work as performed by contractors on Army property. This wastewater system guide contains recommended surveillance methods that can be amended by direction of the KO or QA management to fit the needs of a specific installation.

Guide Series Organization

This series includes the following guides by USACERL published in October 1993:

- #1: Water Systems (Special Report [SR] FF-94/01)
- #2: Wastewater Systems
- #3: Natural Gas Distribution Systems (SR FF-94/03)
- #4: Electrical Systems (SR FF-94/04)
- #5: Heating Systems (SR FF-94/05)
- #6: Ventilation, Air Conditioning, and Refrigeration Systems (SR FF-94/06)
- #7: Building Services (SR FF-94/07)
- #8: Grounds Maintenance (SR FF-94/08)
- #9: Surfaced Areas (SR FF-94/09)

- #10: Refuse and Recyclable Handling (SR FF-94/10)
- #11: Pest Control Services (SR FF-94/11)
- #12: Custodial Services (SR FF-94/12).

The QAE is expected to evaluate a contractor's performance by applying appropriate visual and instrumentation procedures along with necessary technical and interpretive skills. This guide covers QAE inspection of wastewater systems, and is divided into sections that take the inspector through a step-by-step process of recommended performance indicators, inspection tasks, and surveillance methods.

Wastewater systems are divided into two subsystems in this guide:

1. Wastewater Collection
2. Wastewater Treatment.

General QA information, including detailed explanations of the available surveillance methods, is given in Chapter 2.

Chapter 3 provides performance indicators, inspection tasks, and recommended surveillance approaches for each subsystem.

Appendix A contains sampling inspection tables. Appendix B contains QAE Worksheets for each subsystem; they may be reproduced for field use.

2 GENERAL QA INSPECTION INFORMATION

Inspection Organization and Planning

According to custom and standard practice, the contractor submits copies of the previous month's O&M activities and regulatory agency reports to the COR and the QAE. The due dates of these reports control the start of inspection scheduling. If possible, the QAE's inspection should be conducted within 3 days after receiving the reports. Effective coordination will allow more efficient inspection of services. The COR/QAE should look for specific indicators of the contractor's performance and should evaluate that performance based on Detailed Inspection Tasks. The following chapter lists the Performance Indicators and Detailed Inspection Tasks for wastewater systems.

Quality Assurance Surveillance Methods

The QAE can use the following five surveillance methods to determine contractor performance:

1. Random Sampling
2. Planned Sampling
3. 100 Percent Inspection
4. Unscheduled Inspection
5. Customer Complaints.

Random Sampling

The methods are based on statistical criteria provided in Military Standard (MIL-STD)-105E, *Sampling Procedures and Tables for Inspection by Attributes* (10 May 1989) and are presented as recommendations. The methods used should be based on the unique needs of an individual system. Generally, all five methods are not used to evaluate an individual system.

Random sampling is recommended for situations where many work items are candidates for inspection. For instance, because it is impractical to inspect every roof on an installation with 500 buildings, only a select number of the buildings should be inspected. Likewise, in random sampling, only a portion of the total performed work is inspected. Acceptance of the work is based on the assumption that the inspected items are representative of the quality of the contractor's work. The random sampling technique spreads the selected samples evenly throughout the evaluation period. The following are steps to be used by the QAE in random sampling.

Tables A1 and A2 in Appendix A should be used to determine the number of samples to be inspected and the number of rejects allowed as a function of the number of inspected work items for AQLs of 4 and 10 percent, and the level of surveillance. The three levels of surveillance are: normal, increased (tightened), and reduced. Initially, this guide recommends normal surveillance for random sampling. However, under the direction of the KO, the level of surveillance can be changed depending on the contractor's performance.

As an example, assume that the contractor's total scheduled output (i.e., population size) for a particular work item is 125 units and that the normal surveillance level with an AQL of 4 percent has been selected. According to Table A1, 20 of the 125 units of work should be inspected, and the entire output of 125 units should be rejected if 3 or more of the 20 sample units are not acceptable.

The QA Worksheets in Appendix B provide room to record the population size, the number of samples, the maximum number of rejects, and the interval for each Performance Indicator.

The work planned by the contractor for each maintenance task should be listed by date to make it easier to predict the time when the work samples will be ready for inspection.

Planned Sampling

Evaluation by planned sampling inspects some, but not all, of the work activities and is appropriate when the number of work items is large. Some items are evaluated before scheduled completion because they are inaccessible after the work is completed. The COR/QAE subjectively selects key work items for inspection; the sample size is determined arbitrarily.

The COR/QAE will normally use planned sampling when the contractor's performance at selected locations or tasks is poor. With this type of evaluation, the contractor knows that work performed in these areas is more likely to be monitored. Planned sampling provides a systematic way of focusing on specific output and forming conclusions about the contractor's performance level.

100 Percent Inspection

Inspection at 100 percent requires total inspection of all items in a contract requirement. It is normally used to monitor infrequent work or critical contract work when the number of work items is small and in cases where nonperformance could seriously damage Army-furnished equipment or processes. It may also be used in areas where a contractor has had prior performance difficulties.

Unscheduled Inspection

Unscheduled inspections can be used for areas of poor past contractor performance, noncritical areas, areas of infrequent repairs, or as a follow-up check of previous inspections. If the QAE notices such an area, an unscheduled inspection can be conducted to evaluate contractor performance.

Customer Complaints

The customer complaint method is based on an informed and cooperative customer population, that is generally aware of local contract requirements. Customers are expected to monitor contractor services and, when performance is poor or nonexistent, to notify the COR/QAE. If investigation reveals that the complaint is valid, the COR/QAE documents the deficiency. Since this is a reactive QA inspection approach, this method of surveillance normally supplements planned inspection methods.

Increased Surveillance

For areas of poor past contractor performance, the QAE should consult with the KO to intensify the surveillance method. More than one option is usually available, and selection should be based on the initial method and the amount of work performed.

1. Random Sampling (Normal Surveillance) can be replaced by:

- Random Sampling (Increased Surveillance)
- Planned Sampling (for a large population size)

- 100 Percent Inspection (for a small population size)
 - Unscheduled Inspection (for any population size).
2. Planned Sampling can be replaced by:
- Random Sampling (Normal Surveillance)
 - 100 Percent Inspection (for a small population size)
 - Unscheduled Inspection (for any population size).
3. Unscheduled Inspections can be replaced by:
- 100 Percent Inspection (for a small population size)
 - Random Sampling (Normal Surveillance)
 - Planned Sampling.

Decreased Surveillance

For work areas in which the contractor maintains a consistently satisfactory performance for 3 to 6 months, the QAE should consult with the KO to decrease the intensity of the surveillance. More than one option is usually available and selection should be based on the initial method and the amount of work performed.

1. Random Sampling (Normal Surveillance) can be replaced by:
- Random Sampling (Reduced Surveillance)
 - Planned Sampling
 - Unscheduled Inspection (for any population size)
 - Customer Complaints.
2. Planned Sampling can be replaced by:
- Unscheduled Inspection (for any population size)
 - Customer Complaints.
3. 100 Percent Inspection can be replaced by:
- Random Sampling (Normal Surveillance)
 - Random Sampling (Reduced Surveillance)
 - Planned Sampling
 - Unscheduled Inspection (for any population size)
 - Customer Complaints.

3 WASTEWATER SYSTEM QA INSPECTIONS

Wastewater Collection

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. The Preventive Maintenance (PM) checklists and logs are complete, legible, and timely.

Verify that the contractor's PM checklists and logs are complete, legible, and timely. All tasks must be listed, dated, designated as completed, and initialed by the person(s) who performed or accepted the work. Check the reports and logs for completeness in the following areas:

- a. Description of normal inspection and maintenance of the sewer mains, service lines, and lift stations.
- b. Reports of corrective actions taken if stoppages, failures, or overloading occur.
- c. Records indicating leaks, new service lines, and locations of potential cross-connections.
- d. Records of the flushing, rooting, and cleaning of sewer mains.
- e. Records of annual hydrocleaning of wastewater collection lines and sludge removal from septic tanks.

2. An adequate spare parts inventory is being maintained in case of emergency repairs.

Verify that the contractor is maintaining an adequate inventory of wastewater collection spare parts (i.e., piping, fittings, etc.) for emergency repairs. The number and types of spare parts should be determined locally based on installed equipment records and appropriate recommendations/advice found in TM 5-660, TM 5-661, and TM 5-813-5. All sewer main sizes should be represented.

3. The manhole maintenance is satisfactory.

Verify the effectiveness of manhole maintenance using the following indicators:

- a. The manhole frame is tightly sealed to the masonry structure, and masonry joints in the manhole structure are properly sealed with mortar or bituminous material.
- b. The flow channel in the bottom of the manhole is free of accumulated material, allowing smooth flow from all incoming lines into the receiving main.

Note: Safety precautions require that all personnel be accompanied when inspecting underground facilities.

Use two lift bars when opening manhole covers. Exercise care when handling the cover because it is heavy and tends to flip over.

4. The lift station and sewage-handling equipment maintenance is satisfactory.

Verify the effectiveness of lift station and sewage-handling equipment maintenance in areas where:

- a. Recent inspections have shown deficiencies,
- b. No inspections have been conducted in the past 90 days, and/or
- c. Sewage backups or overflows have been reported.

Note: Safety precautions require that all personnel be accompanied when inspecting underground facilities.

Lift Stations

- a. **Pumping Chamber Inspections.** When inspecting lift stations, one member of the inspection team should remain aboveground in case of an accident. Ventilating fans, if present, should operate for at least 1 minute before entering the pump chamber. Verify that:
 - (1) The pump chamber is well lighted, and steps, handrails, and gratings are solidly in place.
 - (2) Litter or discarded repair parts have not accumulated.
 - (3) All exposed metal surfaces are free of rust or peeling paint.
 - (4) If the wet well is part of the pump chamber, check that the water level is normal and look for high-water marks that might indicate recent flooding.
- b. **Wet Well Inspections.** Wet wells are holding chambers for wastewater coming into a pumping station; they provide a collection point for grit and heavy solids that could damage lift pumps. Check that:
 - (1) The water level is normal and there are no high-water marks that might indicate recent flooding.
 - (2) The top of the sludge accumulation is always a minimum of 18 in. below the pump suction line. Each lift station should have a probe to measure the depth of sludge accumulated in the bottom of the wet well.

Sewage-Handling Equipment. Compare the frequency and cost of required repairs for sewage-handling equipment with historical records as a measure of the contractor's effectiveness. If the interval between repairs has decreased significantly, notify the KO. If historical data is unavailable, begin a repair file on each major component for future reference.

5. Sanitary sewer line and sewage-handling equipment problems are promptly identified, the equipment is efficiently repaired, and the system is restored to service.

Verify that sanitary sewer line and sewage-handling equipment problems are promptly identified, the equipment is efficiently repaired, and the system is restored to service. Repair work performed under a work order should be evaluated by unscheduled inspections of the individual work orders. Visit the repair site to verify that the work is being performed diligently with minimal service interruption. When the repair work is finished, check that the construction area is clear of debris and excavated areas are graded to match the surrounding area. Recheck the site later to see that excavated areas that have settled have been reshaped.

6. Cathodic protection for wastewater tanks and underground conductive piping is adequate.

Check all wastewater tank and underground conductive piping cathodic protection equipment to ensure that adequate protection against corrosion still exists.

7. "As-built" drawings are updated with changes and corrections.

Verify that the contractor maintains current "as-built" drawings of wastewater collection facilities and equipment. Check to see that the drawings are updated annually with all changes and corrections. The drafter's initials and the date should accompany each change.

8. An adequate library of equipment manufacturers' manuals is being maintained.

Verify that the contractor maintains an adequate library of manufacturers' manuals for equipment and facilities. Manuals should be obtained for newly installed equipment, and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicators #1 and #2 monthly using the 100 percent inspection method.
- Evaluate performance indicator #3 monthly using random sampling (normal surveillance, 10 percent AQL).
- Evaluate performance indicators #4 and #5 periodically using the unscheduled inspection method.
- Evaluate performance indicators #6 through #8 annually using the 100 percent inspection method.

Wastewater Treatment

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. The PM logs and checklists are complete, acceptable, and timely.

Verify that the contractor's PM logs and checklists are complete, legible, and timely. All tasks must be listed, dated, designated as completed, and initialed by the person(s) who performed or accepted the work. Check for the following documentation:

- a. Descriptions of normal inspections and O&M activities of the wastewater treatment plant, including copies of laboratory analyses of effluent samples.

- b. Reports of corrective actions taken in the event of equipment failure, overloading, or failure to meet National Pollutant Discharge Elimination System (NPDES) permit requirements for effluent quality.
 - c. Recommended improvements to the treatment plant which will increase its performance, or repairs to damaged or deteriorated components.
2. The plant equipment repair frequency is satisfactory.

Evaluate the contractor's repair effectiveness by comparing the frequency and cost of required repairs with historical records of the wastewater treatment plants. If the interval between repairs has decreased significantly, notify the KO. If historical data is unavailable, start a repair file on each major component for future reference.

3. The operation and maintenance of wastewater treatment facilities is satisfactory.

Visit all wastewater treatment facilities monthly and evaluate the effectiveness of the contractor's O&M for each plant based on the following:

- a. General. Check that the buildings and grounds look neat and are free of litter:
 - (1) Grassed areas around the buildings and plant components are mowed and trimmed.
 - (2) Buildings and exposed pipes are free of rust and peeling, deteriorated paint.
 - (3) Cleaning equipment and debris from repairs are removed from the site.
- b. Bar Screens. Verify that material screened from the incoming wastewater was removed from the bar screens and placed in a container for disposal.
- c. Grit Removal. Check that the amount of sediment collected in the grit removal channel since the last cleaning is less than 1/4 in.
- d. Comminutor. Verify that:
 - (1) Lubrication fittings are clean and bright, indicating frequent use, and their surfaces show a film of lubricant.
 - (2) The comminutor is operating smoothly and quietly, and the cutters are clear of debris.
- e. Primary Clarifiers. Check that:
 - (1) The water surface in the clarifiers is reasonably clear of floating solids.
 - (2) Material removed from the surface is placed in containers for disposal.
 - (3) Gas bubbles are rising from the sludge digestion process in the bottom of the tanks to the water surface.
 - (4) Accumulated sludge is at least 12 in. below the bottom of the baffles.

f. Filters. Verify that:

- (1) The distribution system spreads the wastewater evenly across the filter bed.**
- (2) The movement of the distribution equipment is smooth and quiet.**
- (3) Lubrication points are clean and bright, indicating frequent use.**
- (4) Large numbers of flies are not present.**
- (5) The filter's surface does not contain ponded water.**

g. Secondary Clarifiers. Check to see that:

- (1) The water surface in the secondary clarifiers is reasonably clear of floating solids.**
- (2) Material removed from the surface is placed in containers for disposal.**
- (3) Gas bubbles are not rising from the bottom of the clarifier tanks to the water surface, which indicates an excess of settled sludge.**

h. Pumping Equipment. Verify that:

- (1) Pumps, piping, brackets, handrails, and other metal surfaces are painted and free of rust.**
- (2) The pump room is free of accumulated debris and is washed clean.**
- (3) Pumps and motors are running smoothly and quietly without unusual grinding, scraping, or squealing noises. Noise or excessive vibration during operation might indicate a bearing or shaft alignment problem. QA instrumentation is especially recommended to measure lift station pump operation:**
 - (a) Motor vibration by attached sensors or portable probes**
 - (b) Motor heating by thermocouple or infrared (IR) measures**
 - (c) Shaft vibration (misalignment) by forked probe vibration meter**
 - (d) Bearing condition by shock & frequency measures.**
- (4) Lubrication reservoirs are more than half full, and lubricant flow is visible when the pumps are running. Grease fittings are clean and bright, indicating frequent use, and have a slight film of residual lubricant on the surface.**
- (5) Pump air inlets, air impellers, and heat exchange surfaces are clean of dust and dirt that may impede the pump from functioning efficiently.**
- (6) Pipe networks and tanks within the wastewater plants show no signs of leakage.**

4. Effluent quality reports show that National Pollutant Discharge Elimination System (NPDES) permit requirements are met.

Verify that effluent samples meet NPDES permit requirements. Besides checking the documentation for compliance with effluent standards, collect an effluent sample monthly and deliver it to a licensed testing laboratory for analysis.

5. Plant equipment problems are promptly identified, the equipment is efficiently repaired, and the system is restored to service.

Verify that plant equipment problems are promptly identified, the equipment is efficiently repaired, and the system is restored to service. Evaluate the contractor's repair performance using unscheduled inspections of individual work orders. Visit the site of the selected repair to verify that the work is being performed diligently with minimal service interruption. After completion of the repair work, verify that the construction area is clear of debris and that any excavated areas are graded to match the surrounding area. Recheck the site later to see that excavated areas that have settled are reshaped.

6. "As-built" drawings are updated with changes and corrections.

Verify that the contractor maintains current "as-built" drawings of wastewater treatment facilities and equipment. See that the drawings are updated annually with all changes and corrections. The draftperson's initials and the date should accompany each change.

7. An adequate library of equipment manufacturer's manuals is being maintained.

Verify that the contractor maintains an adequate library of manufacturer's manuals for equipment and facilities. Manuals should be obtained for newly installed equipment, and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicators #1 through #4 monthly using the 100 percent inspection method.
- Evaluate performance indicator #5 periodically using the unscheduled inspection method.
- Evaluate performance indicators #6 and #7 annually using the 100 percent inspection method.

METRIC CONVERSION TABLE

1 in.	=	2.54 cm
1 gal	=	3.78 L
1 psi	=	6.89 kPa
°F	=	(°C + 17.78) x 1.8

ACRONYMS

AQL	Acceptable Quality Level
COR	Contracting Officer's Representative
DEH	Director of Engineering and Housing
KO	Contracting Officer
MIL-STD	Military Standard
O&M	Operations and Maintenance
QA	Quality Assurance
QAE	Quality Assurance Evaluator
QASP	QA Surveillance Plan

REFERENCES

- Johnson, James, Special Report FF-93/DRAFT, *Catalog of Industrial Instrumentation for Army Real Property Quality Assurance Applications* (U.S. Army Construction Engineering Research Laboratory, 1993).
- Military Standard 105E, *Sampling Procedures and Tables for Inspection by Attributes* (Department of Defense, 10 May 1989).
- Technical Manual (TM) 5-660, *Maintenance and Operation of Water Supply, Treatment, and Distribution Systems* (Headquarters, U.S. Army Corps of Engineers [HQUSACE], 30 August 1984).
- TM 5-661, *Inspection and Preventive Maintenance Services for Water Supply Systems at Fixed Installations* (HQUSACE, 21 September 1945).
- TM 5-813-5, *Water Supply: Water Distribution* (HQUSACE, 3 November 1986).

APPENDIX A: Inspection Sampling Tables

Table A1

Sample Sizes and Reject Levels (4% AQL)
(As developed from Tables I & II in MIL STD 105E)

Population Size	Normal Surveillance			Increased (Tightened) Surveillance			Reduced Surveillance		
	Class II Sample Size	Reject Level		Class III Sample Size	Reject Level		Class I Sample Size	Reject Level	
08 to 50	*	25%	1	*	40%	1	*	-	-
51 to 90	E	13	2	F	20	2	*	3%	1
91 to 150	F	20	3	G	32	3	*	3%	1
151 to 280	G	32	4	H	50	4	E	5	2
281 to 500	H	50	6	J	80	6	F	8	3
501 to 1200	J	80	8	K	125	9	G	13	4
1201 to 3200	K	125	11	L	200	13	H	20	5

The Reject Level is the number of failed inspections requiring rejection of the Lot (population).
An asterisk (*) indicates that the sample level is outside the range of a 4% AQL for the selected class.

Table A2

Sample Sizes and Reject Levels (10% AQL)
(As developed from Tables I & II in MIL STD 105E)

Population Size	Normal Surveillance			Increased Tightened Surveillance			Reduced Surveillance		
	Class II Sample Size	Reject Level		Class III Sample Size	Reject Level		Class I Sample Size	Reject Level	
06 to 15	*	33%	1	*	50%	1	*	-	-
16 to 25	C	5	2	D	8	2	*	8%	1
26 to 50	D	8	3	E	13	3	C	2	2
51 to 90	E	13	4	F	20	4	C	2	2
91 to 150	F	20	6	G	32	6	D	3	3
151 to 280	G	32	8	H	50	9	E	5	4
281 to 500	H	50	11	J	80	13	F	8	5
501 to 1200	J	80	15	K	125	19	G	13	6
1201 to 3200	K	125	22	L	200	19	H	20	8

The Reject Level is the number of failed inspections that require rejection of the Lot (population).
An asterisk (*) indicates that the sample level is outside the range of a 10% AQL for the selected class.

Table A3

Random Numbers

2	6	1	6	9	3	5	5	1	1	3	1	2	5	5	1	7	8	7	5	6	6	8	4	4	9	4	6	2	8	9	3	5
1	8	1	4	5	9	2	7	2	2	5	4	9	1	9	2	9	4	9	2	9	3	6	3	5	1	4	3	1	1	1	6	1
4	2	3	6	8	4	6	3	2	6	6	8	8	5	4	9	1	1	3	2	8	6	1	9	8	7	1	2	4	3	4	1	3
2	7	2	4	8	8	8	3	5	3	3	2	6	3	9	3	2	7	7	1	8	3	5	9	6	8	1	5	9	3	2	4	6
8	4	1	3	7	4	4	6	1	6	9	6	3	7	5	6	2	1	4	3	2	8	5	7	8	2	4	7	7	7	4	2	6
2	6	4	8	1	5	4	9	7	1	7	3	3	7	2	1	7	4	4	7	7	8	2	7	5	7	6	5	6	6	2	5	8
1	9	8	6	9	6	8	3	7	5	4	1	3	6	1	1	3	3	2	8	7	5	4	1	9	1	4	9	7	1	8	4	8
1	4	3	7	5	6	5	5	9	9	4	6	4	6	2	3	4	5	8	9	9	9	8	3	2	3	2	7	7	5	9	9	8
8	3	6	3	8	6	3	8	9	6	1	9	3	9	8	3	9	8	5	6	4	9	5	8	7	4	3	7	8	2	3	8	4
1	5	2	5	8	3	7	5	2	3	7	9	4	4	4	4	8	3	1	2	6	7	2	9	9	7	8	4	2	3	4	1	4
1	5	7	2	9	4	2	5	6	4	8	6	1	3	5	4	5	1	9	2	2	1	5	9	7	5	7	6	7	5	5	6	3
6	9	2	7	1	9	7	7	5	4	3	6	6	3	6	3	4	4	6	6	8	3	8	1	4	7	9	1	4	7	2	7	7
2	5	5	8	6	6	7	8	5	8	2	6	2	4	3	2	7	6	6	1	7	4	3	2	8	4	8	9	3	1	7	7	7
6	1	1	9	1	9	2	9	9	9	1	2	8	6	4	7	3	7	5	4	7	1	8	1	3	4	2	1	5	9	2	5	7
9	9	5	1	1	4	8	9	9	8	2	6	9	3	3	2	5	9	5	7	9	6	2	8	3	1	1	9	3	3	1	6	2
9	6	1	8	8	7	7	8	3	2	2	5	2	6	3	6	6	4	5	2	2	8	1	3	3	2	3	3	6	9	3	9	4
2	2	8	7	7	3	8	1	7	8	2	8	8	3	3	9	8	5	7	1	7	3	6	2	7	6	5	9	6	8	2	7	7
3	9	6	7	1	1	4	7	3	6	9	2	7	4	8	8	3	2	5	8	4	2	2	9	1	4	8	4	6	5	3	6	4
3	6	4	2	9	6	4	4	6	9	7	8	8	4	7	3	5	5	1	7	9	5	9	8	4	8	7	1	1	3	2	5	8
7	6	5	6	3	1	9	7	8	9	8	1	7	6	8	8	9	3	5	8	3	1	9	4	6	7	4	2	7	4	7	9	8
5	4	7	2	8	9	2	7	2	1	3	5	6	1	9	6	8	3	7	8	9	9	6	5	9	6	4	8	7	5	9	5	5
2	2	6	5	1	1	3	3	7	6	1	7	4	4	4	9	5	2	5	9	1	7	2	5	4	9	9	4	9	9	8	8	2
4	6	6	8	6	4	6	1	5	4	6	3	9	6	8	4	5	6	2	4	2	4	1	8	3	8	4	3	5	9	5	9	6
4	5	7	4	1	8	8	2	3	5	6	3	5	3	2	1	8	2	9	2	5	6	5	1	9	9	4	8	4	4	4	4	5
9	9	9	1	1	9	5	8	9	9	8	9	8	3	4	7	9	1	2	5	7	5	3	6	5	4	2	3	1	8	8	3	5
2	2	7	4	6	8	2	2	5	9	4	4	2	3	7	9	5	7	7	8	8	1	3	1	4	3	1	1	6	1	2	5	8
8	5	7	3	9	8	7	9	2	2	1	9	7	9	8	6	1	1	9	8	5	3	6	4	3	3	9	6	3	8	1	5	1
7	9	4	2	3	8	6	1	7	6	7	5	3	4	3	5	2	1	4	7	6	9	1	8	9	2	4	4	3	7	4	8	1
1	3	7	8	6	8	7	8	9	9	3	3	1	6	3	3	8	4	3	3	4	8	1	8	6	3	4	9	9	8	4	5	4
5	4	7	4	9	3	7	3	1	9	2	3	8	7	3	8	9	2	5	1	5	9	4	2	4	9	1	9	9	8	1	7	9
7	6	7	6	2	7	3	2	5	7	9	3	4	4	4	2	6	1	5	2	4	5	1	7	9	9	2	8	6	6	8	8	5
8	4	6	5	9	2	1	3	5	5	1	7	8	6	1	7	9	8	3	6	6	9	1	7	9	2	2	9	6	7	1	5	3
2	3	6	2	7	9	5	6	2	9	7	2	4	2	7	4	7	7	5	4	6	9	7	5	1	9	9	1	2	9	6	7	5
6	2	2	4	5	8	2	9	4	9	5	6	2	6	3	6	2	6	6	2	1	3	9	6	8	4	6	1	4	2	5	7	4
6	3	5	4	9	1	1	2	1	2	7	1	1	5	9	1	1	7	2	3	2	1	1	7	9	5	5	3	8	7	8	9	1
2	4	7	6	7	9	3	2	2	2	2	8	1	3	4	2	9	8	7	6	9	5	7	8	6	5	8	5	3	6	8	6	2
6	9	1	7	1	4	6	4	7	6	5	8	5	4	9	4	8	8	4	5	5	8	1	7	9	5	9	3	2	1	3	7	6
4	8	4	1	9	8	6	4	7	4	4	1	5	9	2	4	3	3	6	7	4	8	9	2	1	5	4	3	7	2	5	1	2
2	1	6	8	6	8	3	6	1	4	5	7	9	6	8	7	2	3	8	6	2	9	9	1	3	4	7	5	4	4	3	9	8
9	8	5	4	5	6	1	4	3	6	2	9	6	1	9	8	1	8	8	9	9	9	5	1	7	4	9	2	1	9	1	6	6
5	3	2	7	5	6	1	3	3	3	5	4	1	2	4	6	2	3	3	2	5	7	9	1	8	3	8	4	6	1	1	1	6
2	2	7	7	2	5	7	2	6	1	1	2	1	6	1	8	6	6	8	1	2	1	4	8	5	2	8	4	1	1	7	3	9
2	8	9	4	9	9	6	8	4	3	2	3	9	9	4	7	3	2	4	1	9	6	5	4	1	8	5	3	7	7	3	6	9
2	3	4	9	7	5	3	2	4	6	4	4	6	8	6	3	1	1	8	9	6	4	7	7	6	3	1	5	7	8	9	7	7
6	7	9	5	5	8	5	4	4	5	6	1	4	9	4	5	3	1	7	3	2	1	8	6	2	2	4	7	8	1	4	5	9
5	3	7	8	6	6	4	1	1	4	4	2	5	1	1	4	8	9	4	2	8	9	9	7	2	4	7	8	4	1	8	1	1
7	2	3	2	1	7	2	8	6	4	6	9	7	3	9	3	3	4	4	7	1	4	4	8	8	6	7	4	1	9	9	5	1
8	4	3	4	9	2	7	2	6	3	7	9	8	3	1	9	9	5	8	7	1	2	9	9	6	6	8	8	8	7	8	4	8

APPENDIX B: QAE Inspection Worksheets

Wastewater Collection Worksheet

Page 1 of 5

Performance Indicator #1: The PM checklists and logs are complete, legible, and timely.

- a. All performed tasks are dated and initialed by the operator(s).

S U N

- b. The documentation includes descriptions of normal inspection and maintenance of the sewer mains, service lines, and lift stations.

S U N

- c. The documentation includes reports of corrective actions taken if stoppages, failures, or overloading occur.

S U N

- d. The documentation includes records of leaks, new service lines, and locations of potential cross-connections.

S U N

- e. The documentation includes records of the flushing, rooting, and cleaning of sewer mains.

S U N

- f. The documentation includes records of annual hydro-cleaning of wastewater collection lines and sludge removal from septic tanks.

S U N

Remarks:

Performance Indicator #2: An adequate spare parts inventory is being maintained in case of emergency repairs.

S U N

Remarks:

Performance Indicator #3: The manhole maintenance is satisfactory.

- a. The manhole frame is tightly sealed to the masonry structure, and masonry joints in the manhole structure are properly sealed with mortar or bituminous material.
- b. The flow channel in the bottom of the manhole is free of accumulated material, and it allows smooth flow from all incoming lines into the receiving main.

Using the population size_____, and referring to normal surveillance in Tables A1 and A2 gives_____number of samples and_____number of allowable rejects.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #4: The lift station and sewage-handling equipment maintenance is satisfactory.

a. Lift Station Pumping Chamber:

- (1) The pump chamber is well lighted, and steps, handrails, and gratings are solidly in place.
- (2) Litter or discarded repair parts have not accumulated.
- (3) All exposed metal surfaces are free of rust or peeling paint.

b. Lift Station Wet Well:

- (1) The water is normal and there are no high-water marks that might indicate recent flooding.
- (2) The top of the sludge is sufficiently below the pump suction line.

c. Sewage-Handling Equipment: The frequency and cost of required repairs is satisfactory.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #5: Sanitary sewer line and sewage-handling equipment repairs are promptly identified, efficiently repaired, and restored to service.

- a. Repair work is being performed diligently with minimal service interruption.
- b. The construction area is clear of debris.
- c. Excavated areas that have settled are reshaped.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #6: Cathodic protection for wastewater tanks and underground conductive piping is adequate.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #7: "As-built" drawings are updated with changes and corrections.

- a. The draftperson's initials accompany each change.

S U N

- b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #8: An adequate library of equipment manufacturers' manuals is being maintained.

- a. Manuals for new equipment are obtained.

S U N

- b. Obsolete manuals are properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

Performance Indicator #1: The PM logs and checklists are complete, legible, and timely.

- a. All performed tasks are dated and initialed by the operator(s).

S U N

- b. Documentation includes descriptions of normal inspections and activities, including copies of laboratory analyses of effluent samples.

S U N

- c. Documentation includes reports of corrective actions taken in the event of equipment failure, overloading, or failure to meet NPDES permit requirements.

S U N

- d. Documentation includes recommended improvements to the treatment plant.

S U N

Remarks:

Performance Indicator #2: The plant equipment repair frequency is satisfactory.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #3: The operation and maintenance of the wastewater treatment facilities is satisfactory.

- a. General areas are satisfactory.
- b. The bar screens are satisfactory.
- c. Grit removal is satisfactory.
- d. The comminutor is satisfactory.
- e. The primary clarifiers are satisfactory.
- f. The filters are satisfactory.
- g. The secondary clarifiers are satisfactory.
- h. The pumping equipment is satisfactory.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #4: Effluent quality reports show that NPDES permit requirements are met.

- a. The testing reports are complete.
- b. The effluent sample collected meets NPDES standards.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #5: Plant equipment problems are promptly identified, efficiently repaired, and the system is restored to service.

- a. Repair work is being performed diligently with minimal service interruption.
- b. The construction area is clear of debris.
- c. Excavated areas that have settled are reshaped.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #6: "As-built" drawings are updated with changes and corrections.

- a. The draftperson's initials accompany each change.

S U N

- b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #7: An adequate library of equipment manufacturers' manuals is being maintained.

- a. Manuals for new equipment have been obtained.

S U N

- b. Obsolete manuals are properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

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